Purposes," was discussed. The author had found water gas and producer gas practically equal both as regarded cost of production and heating values.

Mr. H. Eccles drew attention, in a paper on "An Imperfection in Mild Steel Plates considered chemically," to want of care in sampling steel before casting, whereby defects in the ingots were rolled out into the plates; and it appeared in the discussion, as well as in a paper by Major Cubillo, on "The Manufacture and Treatment of Ordnance at Trubia," that the ingot was much improved when the steel was made and heated in a radiation furnace. Another paper by Major Cubillo, on "Steel Castings for the Manufacture of Guns," gave rise to a highly technical discussion; as did also papers on "The Behaviour of Arsenic in Ore and Metal during Smelting and Purification Processes," by Messrs. Pattinson and Stead, and on "The Effect of Arsenic on Mild Steel," by Messrs. Harbord and Tucker.

The last paper read was on "A New Instrument for the Measurement of Colour, more especially as applied to the Estimation of Carbon in Steel," by Mr. H. Le Neve Foster. In the instrument are two fields of view under similar monocular conditions, freed from any errors which may arise from the introduction of unequal side lights, and also the different power of distinguishing colour that often exists in the eye of the observer; in conjunction with the instrument is a standard set of coloured glasses, each set being the same colour, but regularly graded for depth of tint. The instrument consists of a tube, divided by a central partition terminating at the eye-piece in a knife-edge, which, being inside the range of vision, is not seen when the instrument is in use. At the other end of the instrument are two apertures of equal size, and alterable in size or shape by means of diaphragms. The two apertures are divided by the thick end of the central partition, which, together with the sides, is recessed so as to hide the edges of the standard glasses, as well as the sides of the gauged glass vessels, which are used to contain the liquid that requires to be matched or compared. The only light coming to the eye must pass in equal quantity through the gauged glass vessel and the standard glasses respectively.

The instrument has been used by dyers, brewers, and sugar, and various other manufacturers. It forms a ready means of measuring the depth of colour in water, and is also applicable for Nessler's ammonia test as used in water analysis. For the estimation of carbon, the author finds the best results are obtained by dissolving 0·5 gramme of steel in 10 c.c. nitric acid, sp. 1·20, and boiling for twenty minutes, and then diluting to 50 c.c. and placing the liquid in a 1-inch cell. For mild steel this gives an easy colour to match, the results obtained agreeing well with those found by the Eggerty method.

SCIENTIFIC SERIALS.

THE *Quarterly Journal of Microscopical Science* for April, 1888 (vol. xxviii. part 4) contains:—A monograph on the species and distribution of the genus Peripatus, Guilding (plates 34 to 40), by Adam Sedgwick, F.R.S., gives an account of all the known species of the genus, with a bibliography of most of the literature relating to them. Many of the figures are coloured from nature.—Notes on the anatomy of *Peripatus capensis* and *P. novæ-zealandiæ*, by Lilian Sheldon, Bathurst Student, Newnham College, Cambridge. Gives details about the crural glands, the segmental organs, the accessory glands of the male, and the vas deferens.—On the construction and purpose of the so-called labyrinthine apparatus of the Labyrinthine fishes (plate 41), by Dr. Nicholas Zograff.—Studies on the comparative anatomy of sponges; (1) on the genera Ridleia, n. gen., and Quasillina, Norman (plate 42), by Arthur Dendy —Kleinenberg on the development of Lopadorhynchus, by G. C. Bourne. This paper gives a *résumé* of Prof. Kleinenberg's very detailed account of the development of the Polychæte Annelid Lopadorhynchus, which extends over 225 pages of the *Zeitschrift für Wissenschaftliche Zoologie.*

American Journal of Science, May.—The absolute wavelength of light, Part 2, by Louis Bell. In continuation of his previous communication the author here gives the angular measurements, and the details of the measurement and calibration of the gratings, together with the final results. He also inquires into the probable sources of error in some recent determinations of wave-length. His own final determination of the mean value of the absolute wave-length for the line D_1 is 5896·18 in air at 760 mm. pressure and 20° C. temperature, or *in vacuo* 5897·90, which he considers not likely to be in error by an amount as great as one part in two hundred thousand.—Three formations of the Middle Atlantic slope (continued), by W. J. McGee. In this paper the author deals with the Columbian formation alone, describing in detail the general characters of its fluvial and interfluvial phases. By the *fluvial* phase he understands the thicker and more conspicuous formations commonly occurring along the great rivers at and for some miles below the fall line, while the *interfluvial* comprises the thinner deposits forming the surface over the remainder of the coastal plain. These interfluvial deposits are shown to corroborate and extend the testimony of the deltas, all the phenomena conjointly recording a brief period of submergence of the entire coastal plain in the Middle Atlantic slope reaching 100 feet in the south and over 400 in the north, with coæval cold, long anterior to the terminal moraine period.—On some peculiarly-spotted rocks from Pigeon Point, Minnesota, by W. S. Bailey. The character and origin are discussed of some curious circular spots occurring here and there on the quartzites of Pigeon Point, a district projecting about 3½ miles into Lake Superior, and consisting mainly of a great dyke of coarse olivine gabbro or diabase.—The Taconic system of Emmons, and the use of the name Taconic in geological nomenclature (continued), by Chas. D. Walcott. In this paper the author deals with the subject of nomenclature, discussing the use of the names Taconic and Cambrian, and concluding with a classification of the North American Cambrian rocks.—Prof. R. D. Salisbury has some remarks on the terminal moraines of North Germany, and Carl Barus communicates a short note on the viscosity of gases at high temperature, and on the pyrometric use of the principle of viscosity.

Bulletin de l'Académie Royale de Belgique, March.—Remarks on some stone implements found in Spain by MM. H. and L. Siret, by A. F. Renard. Amongst the rich archæological finds recently made by MM. Siret in the Carthagena and Almeria districts are some polished stone hatchets of small size and beautiful workmanship. With a view to determining the material of which these implements were made, the author has subjected them to a careful analysis, and finds that this material is fibrolite, which occurs in many parts of Spain. In appearance it somewhat resembles jade, but its chemical composition and general properties show that it is quite distinct from that substance.—Determination of the variations in the specific heat of fluids near the critical point, by P. de Heen. It is suggested as a working hypothesis, that fluids are formed of molecular groups which may be called liquidogenic molecules. These groups and their constituent elements, presenting the aspect of little vortices, would appear simply to be the molecules as regarded in the gaseous state (gasogenic molecules). The transition from the liquid to the gaseous state at the critical temperature might then be thus interpreted. It may be admitted that at a given temperature the *gasogenic molecules* cease to move in closed curves, and describe the rectilinear trajectories of M. Clausius. The author's researches, as here described, tend mainly to confirm this view.

Rendiconti del Reale Istituto, Lombardo, April.—On the importance of the phagociti in the morphology of the Metazoi, by Prof. Leopoldo Magi. The author's researches generally tend to confirm the conclusions of Metschnikoff regarding the physiological functions of the phagociti. He considers that "phagocitism"—that is, the intracellular digestive process—is a function which attests in the morphology of the Metazoi, or pluricellular organisms, their genetic descent from the Protozoi. Thus physiology, as well as embryology and palæontology, confirms the now commonly accepted views regarding biological volution in animal organisms.

Rivista Scientifico-Industriale, April 30.—On some recent discoveries in electro-optics, by Prof. Ercole Fossati. In connection with the recent researches of Hertz and Hallewachs on the influence of light on electrified conductors, attention is directed to the analogous experiments made by Morichini at the beginning of the present century. Reference is made more particularly to this physicist's observations on the magnetization of steel by the effect of light alone, independently altogether of any action caused by heat or terrestrial magnetism.—Researches on magnetic thermogenesis, by Prof. Giuseppe Martinotti. The experiments described in this and previous papers lead to the general conclusion that heat is developed when soft iron, or any other magnetic body, is successively magnetized; and that the

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heat is increased by reversing or even simply interrupting the current, which is in accordance with the modern theories on thermodynamics and molecular polarization. But all these experiments are merely preliminary studies in a field of vast and increasing importance, the cultivation of which may ultimately lead to the greatest discovery of modern times, the determination and application of the laws by which the material universe is governed even in phenomena of a psychic order.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 8.—"Contributions to the Anatomy of the Central Nervous System of Vertebrate Animals: Anatomy of the Brain of *Ceratodus forsteri.*" By Alfred Sanders, M.R.C.S., F.L S.

The brain of Ceratodus has the following general arrangement: the membrane which represents the pia mater is of great thickness and toughness; there are two regions where a tela choroidea is developed; one where it covers in the fourth ventricle, and the other where it penetrates through the third ventricle and separates the lateral ventricles from each other.

The thalamencephalon and the mesencephalon are narrow, and the medulla oblongata is wide. The ventricles are all of large size, and the walls of the lateral ventricles are not completed by nervous tissue. All the cranial nerves are to be seen except the abducens and the hypoglossal. There is a large communicating branch between the trifacial and the vagus. The glossopharyngeal has no separate root, but is a branch of the vagus; the ganglion of the vagus is not the termination of the main trunk, but is an off-shoot from the ramus lateralis; the ganglion gives off the branchial nerves and the ramus intestinalis, the ramus lateralis passing on without entering it.

The minute structure of the dorsal part of the cerebrum presents four layers: externally a layer of finely granular neuroglia, with slight indications of radial striation; next a layer of larger-sized cells; then another layer of neuroglia, with fibrillæ having a tendency to a longitudinal direction; and internally a layer of rounded cells closely crowded together. The ventral part of the cerebrum has only two layers, the external of neuroglia, and the internal of rounded cells.

The olfactory lobes resemble the cerebrum in structure, there is an internal layer of cells continuous with those of the cerebrum, and an external layer of glomeruli olfactori, which seem as if they were the external layer of the cerebrum condensed; and between the two, a layer of longitudinal fibres, on which fusiform cells are developed.

The optic lobes also consist of four layers: externally there is a layer of longitudinal fibrils derived from the optic tract; then a layer of smoothly granular neuroglia; then a layer of transverse fibrillæ which collect into a commissure in the central line at the dorsal surface. This layer also contains fusiform and rounded cells sparsely scattered through it; and internally there is a layer of cells mostly rounded. At the central line on the dorsal surface there is a ganglion of large cells resembling those of the optic lobe of the Plagiostomata.

The cerebellum is a mere bridge over the fourth ventricle. Its structure presents the usual number of layers: internally the fibrous layer, which ultimately forms the crura cerebelli ad medullam; then the granular layer, the cells of which are of large size compared to those of the same layer in Teleostei and Plagiostomata; then a layer of Purkinje cells, of which the form and the number of processes are not uniform; externally is the molecular layer, which consists of a coarsely granular network derived from the processes of the Purkinje cells, also a network of finer fibrils and many rounded cells.

In the spinal cord there are three columns of longitudinal fibres on each side in the white substance: viz. the ventral columns between the two ventral roots of the spinal nerves; the lateral columns between the dorsal and ventral roots; and the dorsal columns between the two dorsal roots. Fibres of large size are scattered throughout the two former columns, but collected principally in the ventral. The dorsal consists entirely of minute fibres.

The principal feature in the white substance is a fibre of gigantic size, which is situated on the summit of the ventral columns, one on each side; it consists of a common medullary sheath; inclosing (where the fibre is largest) about 40 to 50 axis-cylinders; these have the character of the axis-cylinders of the ordinary fibres of the white substance, but have no separate medullary sheaths; this fibre is traceable throughout the spinal cord; commencing opposite the posterior end of the abdomen, it extends to a short distance behind the exit of the facial nerve; it varies in size, and becomes of the greatest diameter near the posterior end of the medulla oblongata; its axes escape through the medullary sheath, and join the longitudinal fibres of the ventral columns. Near its anterior termination all the axes have escaped except one; at this point it bears a great resemblance to Mauthner's fibre in the Teleostei. This remaining fibre decussates with that of the other side a short distance behind the exit of the facial nerve, and enters the root of that nerve on the opposite side.

In the gray substance of the spinal cord, there are two series of ganglia, one in the ventral horn, which consists of multipolar cells often of very large size. They send processes into the ventral and lateral columns, which often become the smaller-sized longitudinal fibres. The cells of the other series of ganglia are of smaller size, and are situated in the substantia gelatinosa centralis; they are smooth in outline, and give off one or two processes; they probably have to do with the dorsal roots of the spinal nerves. Cells also of this kind occur at other places, as in the fibræ rectæ, and in the field of the ventral columns.

The transverse commissures are: one in the spinal cord, which passes through the substantia gelatinosa centralis over the central canal; another on the ventral side of the anterior part of the medulla oblongata, which corresponds to the commissura ansulata of the Teleostei, and is connected with the commissure in the dorsal part of the optic lobes; then there is the posterior commissure at the posterior part of the third ventricle; and a commissure at the posterior end of the cerebrum which is the anterior commissure.

There is no chiasma of the optic nerves visible externally; what there is of it, is situated in the substance of the thalamencephalon. The anterior root of the fifth nerve arises from a ganglion occupying a broad swelling at the lateral part of the gray matter of the floor of the fourth ventricle. The posterior root arises from the summit of the restiform bodies.

The facial passes backward in a small tubercle at the junction of the floor of the fourth ventricle with the restiform bodies.

The acusticus arises from a bundle of fibres which are situated on the summit of the ventral column, and appear to be a continuation forward of part of the multi-axial fibre which has not decussated.

The five roots of the vagus pass backward, and enter in succession the same tubercle as, and to the outside of, the facial nerve; the three posterior roots are double, so that the vagus is equivalent to eight nerves, and consists entirely of dorsal roots.

Two nerves are given from the ventral side of the medulla oblongata, each of which has two roots; they do not join the vagus, and pass back some distance within the vertebral canal, and emerge on a level with the exit of the dorsal roots of the spinal nerves.

The second and third spinal nerves supply the pectoral fin, and follow the course usually pursued by the hypoglossal when that nerve is present in Teleostei.

The fibres of the ventral roots of the spinal nerves enter in a direction upward and forward toward the inner edge of the multiaxial fibre, between it and the central canal, and then passing over the dorsal edge of the same are either lost in the gray substance of the ventral horn, join a process of one of the multipolar cells, or become one of the longitudinal fibres of the ventral columns of the cord.

The brain of Ceratodus presents an embryonic condition in three points: viz. first, in the extreme size of the ventricles and the tenuity of the substance of their walls; second, in the alternating origins of the dorsal and ventral roots; third, in the origin of the dorsal roots close to the central line.

Compared to Protopterus, it differs in the shape and imperfection of the cerebral lobes, and in the fact of its having a well-developed rhinencephalon; but it agrees in the narrowness of the mesencephalon, and breadth of the medulla oblongata, and in the rudimentary character of the cerebellum.

Ceratodus agrees also with the Ganoids in the comparative narrowness of the mesencephalon, and in the proportions of the cerebellum.

With the Plagiostomata it agrees in the structure of the optic

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